

REMARKS

In view of the above amendments and following remarks, reconsideration of the rejections contained in the Office Action of May 13, 2005 is respectfully requested.

The Examiner's objection to the drawings is acknowledged. Accompanying this response is a Submission of Replacement Drawing correcting the matters noted by the Examiner.

Claims 36-43 were rejected by the Examiner as being unpatentable over either Lenkersdorfer, U.S. Patent 6,213,844 (Lenkersdorfer) in view of Watanabe et al., U.S. Patent 5,951,368 (Watanabe) and Osterheld, U.S. Patent 6,616,513 (Osterheld). However, it is respectfully submitted that the present invention, particularly as amended above, clearly distinguishes over Lenkersdorfer, Watanabe and Osterheld.

As is clear from the specification of the present application, a substrate is polished while the substrate carrier holds the substrate so that it is overhanging the outer peripheral portion of the polishing table for polishing of both the first and second layer.

Thus, during a polishing operation, by measuring the thickness of the surface layer of the radially outwardly extending portion of the substrate W, the measuring device 10-4 is able to take real-time measurements of a thickness of a surface layer of the substrate W. Specifically, as polishing of the substrate W proceeds, the layer thickness measuring device 10-4 measures the thickness of the plated copper layer 106, the seed layer 107 and the barrier layer 105 in sequence and, then, detects the insulating layer 102 and outputs signals indicating results of the measurement and the detection to the controller 20. To effect an appropriate measurement layer thickness measuring device 10-4, it is preferable to remove the slurry from the surface of the radially outwardly extending portion of the substrate W. To this end, in this embodiment, there is provided a nozzle 10-14 for directing pure water to the surface. (See page 9, section [0043] of the specification.)

The attitude control mechanism allows polishing to be carried out in this manner.

Thus, both independent claims 37 and 40 have been amended to recite that the substrate carrier has a polishing position in which both the first layer and the second layer of the substrate are

polished, and in which polishing position the substrate carrier extends outwardly of the outer peripheral portion of the polishing table so that the substrate extends outwardly of the outer peripheral portion of the polishing table. Further, both claims 37 and 40 now recite that the thickness measurement device is positioned below the substrate carrier, and thus the substrate carried by the substrate carrier, in the polishing position during polishing of the first layer and the second layer of the substrate.

Accordingly, with the present invention, as claimed, multi-step polishing of the substrate is performed while keeping the substrate at least partially overhanging the outer peripheral portion of the polishing table. This is done by setting the polishing position for the substrate carrier as now defined in the claims. Such is not the case with the prior art cited by the Examiner.

In Lenkersdorfer, the substrate overhangs the polishing surface upon the measurement of the film thickness. However, Lenkersdorfer does not disclose or suggest polishing the wafer while maintaining the wafer under such an overhanging condition. This is apparent from the following description of Lenkersdorfer:

Unlike the prior art methods of detecting film 430 endpoint (desired thickness) that continuously measures the film thickness with each oscillation of wafer 125 past the perimeter of pad 250, the methods according to the present invention include polishing wafer 125 for a predetermined amount of time, measuring the film thickness at the end of the amount of time, calculating an amount of time to continue polishing, and, if necessary, polishing for the calculated amount of time. (Column 5, lines 37-46)

That is, although in Lenkersdorfer the wafer is oscillated less frequently than in the prior art, the wafer is still oscillated so as to place the wafer under the overhanging condition in order to measure the film thickness. However, this condition is different from that of the present invention, wherein the wafer is always maintained under the overhanging condition throughout the polishing.

Lenkersdorfer in fact teaches that after the wafer is polished for a predetermined period, the wafer is moved to an overhanging condition in order to effect the film thickness measurement. This can be more clearly understood from the following descriptions of Lenkersdorfer:

a) "The workpiece is polished for a predetermined amount of time, the wafer is then moved to the perimeter of a polishing surface and film thickness measurements are obtained." (ABSTRACT)

b) "moving the workpiece further from said center of said polishing surface such that at least portion of the workpiece surface overhang said polishing surface; and

measuring a film thickness on said at least a portion of the workpiece surface which overhangs said polishing surface" (claim 1)

c) Wafer 125 is then moved to a measurement location; for example, the center of wafer 125 may be moved to about 15 inches from the center of platen 300 to allow measurements on surface 300." (Column 5, lines 8-11)

Thus, the conditions of Lenkersdorfer are quite distinct from those of the present invention in which the polishing position of the substrate carrier for polishing of both the first and second layers is such that the substrate carrier and the substrate will overhang the polishing table so that the thickness measurement device is positioned below the substrate carrier and thus the substrate.

It is noted that the arrangement of the present invention enables the reduction in the diameter of the polishing table, thus enabling reduction of the size of the overall polishing apparatus. Such additional advantages of the present invention are further not disclosed or suggested by the prior art. Such an additional advantage is further reflected by new claim 44, which recites that the polishing table has a polishing surface the diameter of which is substantially 1½ times the diameter of the substrate. Note section 57 on page 13 of the original specification.

Thus, it is possible to substantially reduce the diameter of the turntable, and thereby the size of the polishing apparatus. In a conventional polishing apparatus, for example, the diameter of the turntable was about three times the diameter of the wafer. However, with the present invention, because the wafer is always maintained under the overhanging condition throughout polishing, it is possible to reduce the diameter of the polishing table to about 1½ times the diameter of the wafer. Such aspects are not taught or suggested in any of the cited references.

Osterheld was cited for including a water nozzle to rinse the pad. However, it does not cure the defects of Lenkersdorfer. Watanabe was cited as teaching a polishing apparatus which can

control the attitude of a top ring. Similarly, however, Watanabe does not cure the deficiencies of Lenkersdorfer with respect to claims 37 and 40 as now amended, and new claim 44.

It is assumed that the reference to Sandhu et al. in the second paragraph of page 4 of the Office Action is mistaken, as there is otherwise no discussion of Sandhu.

In view of the above, it is respectfully submitted that the present invention now clearly distinguishes over all of the references cited by the Examiner. Indication of such is respectfully requested.

In view of the above amendments and remarks, it is submitted that the present application is now in condition for allowance, and the Examiner is requested to pass the case to issue. If the Examiner should have any comments or suggestions to help speed the prosecution of this application, the Examiner is requested to contact Applicants' undersigned representative.

Respectfully submitted,

Norio KIMURA et al.

By:



Nils E. Pedersen
Registration No. 33,145
Attorney for Applicants

NEP/krg
Washington, D.C. 20006-1021
Telephone (202) 721-8200
Facsimile (202) 721-8250
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